Problem 5: Doors in the Barracks

USMA D/Math Problem of the Week

Submission Deadline: 16 October, 2008 at 1600

Circle one:	cadet	faculty	other

Problem Statement:

One thousand bored cadets are in the barracks, each in a room numbered between 1 and 1000. The first cadet (the most bored, and thus in room number 1) leaves his room and opens the door to every room. The second cadet, in room number two, goes out and closes the door to every room with an even number. The third cadet, in room number three, examines the doors of the rooms divisible by three, opening all of these that are closed and closing all of them that are open. The other cadets proceed, in order, in the same manner, changing the state of each door to a room which has a number divisible by their own room number. How many doors are open after the last cadet is finished?

Extra Credit: Which are which? In other words, describe an exact way to determine if a door is open or closed. For lots of extra credit, make it work in general, if there are n rooms, rather than 1000.